CLAIMS

What is claimed is:

1. A transmitter comprising:

a parser to parse a block of bits representing an orthogonal frequency division multiplexed symbol into groups of a variable number of coded bits;

subcarrier modulators to individually modulate the groups on orthogonal frequency division multiplexed subcarriers in accordance with spatial-frequency subcarrier modulation assignments to generate symbol-modulated subcarriers; and

IFFT circuitry to generate time domain waveforms from the symbol-modulated subcarriers for subsequent RF transmission over a plurality of spatial channels.

2. The transmitter of claim 1 wherein the time domain waveforms together comprise the orthogonal frequency division multiplexed symbol, and

wherein each orthogonal frequency division multiplexed subcarrier has a null at substantially a center frequency of the other subcarriers to achieve substantial orthogonality between the subcarriers.

3. The transmitter of claim 2 wherein one of a plurality of spatially diverse antennas is associated with a corresponding one of the spatial channels to individually transmit one of the time domain waveforms resulting from an IFFT performed on the symbol-modulated subcarriers,

wherein the spatial channels are non-orthogonal spatial channels having at least slightly different multipath characteristics, and

wherein the variable number of coded bits of each group is based on a subcarrier modulation assignment for a corresponding one of the orthogonal frequency division multiplexed subcarriers and a corresponding one of the spatial channels.

4. The transmitter of claim 2 further comprising a beamformer to perform beamforming on the time-domain waveforms for subsequent RF transmission over the spatial channels with a single antenna.

5. The transmitter of claim 1 wherein:

the subcarrier modulators comprise subcarrier modulation circuitry to individually modulate each orthogonal frequency division multiplexed subcarrier; and

the IFFT circuitry comprises IFFT circuitry associated with each of the spatial channels to individually generate differing time domain waveforms for the orthogonal frequency division multiplexed subcarriers based on modulated symbols provided by the subcarrier modulators.

6. The transmitter of claim 5 further comprising RF circuitry associated with each of the spatial channels, the RF circuitry to RF modulate the time domain waveforms provided by the IFFT circuitry for transmission over an associated one of the spatial channels.

7. The transmitter of claim 1 wherein the spatial-frequency subcarrier modulation assignments comprise a modulation assignment for each orthogonal frequency division multiplexed subcarrier for each of the spatial channels.

8. The transmitter of claim 1 wherein the parser is a spatial-frequency parser to parse a block of bits of a variable size into spatial-frequency groups of bits, each spatial-frequency group being associated with a spatial component and a frequency component of the orthogonal frequency division multiplexed symbol, the spatial component being associated with one of the spatial channels, the frequency component being associated with one of the orthogonal frequency division multiplexed subcarriers.

9. The transmitter of claim 1 wherein the spatial-frequency subcarrier modulation assignments are provided by a receiving station based on channel

characteristics for each of the orthogonal frequency division multiplexed subcarriers for each of the spatial channels, and

wherein the channel characteristics comprise a signal to noise and interference ratio (SINR) measured by the receiving station for the spatial channels.

10. The transmitter of claim 1 wherein the number of groups is equal to a number of the spatial channels multiplied by a number of the orthogonal frequency division multiplexed subcarriers.

11. The transmitter of claim 10 wherein the variable number of coded bits of a group comprises between zero and ten bits, and

wherein the orthogonal frequency division multiplexed subcarriers comprise N subcarriers,

wherein the plurality of spatial channels comprises M spatial channels, and

wherein the subcarrier modulators comprise individual subcarrier modulation circuitry for each of subcarriers, the individual subcarrier modulation circuitry to individually modulate a group of bits for each spatial channel, and

wherein the parser provides NxM groups of bits, where N and M are both positive integers less than 100.

12. The transmitter of claim 1 wherein the individual subcarrier modulation assignments comprises one of no modulation, BPSK modulation, QPSK modulation, 8-PSK modulation, 16-QAM, 32-QAM, 64-QAM, 128-QAM and 256-QAM for each of the orthogonal frequency division multiplexed subcarriers.

13. The transmitter of claim 3 wherein a wideband channel comprises up to four subchannels, each comprising a plurality of the spatial channels,

wherein the subchannels have bandwidths of approximately 20 MHz,

wherein each subcarrier of a subchannel is assigned an individual spatial-frequency subcarrier modulation assignment comprising between zero and ten bits per symbol, and

wherein each subcarrier is to be modulated in accordance with one of the spatial-frequency subcarrier modulation assignment associated with a corresponding one of the spatial channels, and

wherein the transmitter transmits the orthogonal frequency division multiplexed symbol over the spatial channels of each subchannel of the wideband channel.

14. A receiver comprising:

FFT circuitry to generate frequency domain representations of a symbol received over orthogonal frequency division multiplexed subcarriers of a plurality of spatial channels;

subcarrier demodulators to demodulate the frequency domain representations for each subcarrier in accordance with spatial-frequency subcarrier modulation assignments to generate groups of bits; and

a deparser to combine the groups of bits to generate a block of coded bits representing the symbol.

15. The receiver of claim 14 wherein the FFT circuitry generates a frequency domain representation from each of the spatial channels, and

wherein each orthogonal frequency division multiplexed subcarrier has a null at substantially a center frequency of the other subcarriers to achieve substantial orthogonality between the subcarriers.

16. The receiver of claim 15 wherein each one of a plurality of spatially diverse antennas is associated with a corresponding one of the spatial channels,

wherein the spatial channels are non-orthogonal spatial channels having at least slightly different multipath characteristics, and

wherein each group comprises a variable number of coded bits based on the spatial-frequency subcarrier modulation assignment for a corresponding one

of the orthogonal frequency division multiplexed subcarriers and a corresponding one of the spatial channels.

17. The receiver of claim 15 wherein radio-frequency signals of the spatially channels are received through a single antenna, and wherein the receiver further comprises a beamformer to separate signals of the spatial channels.

18. The receiver of claim 14 wherein the symbol is an orthogonal frequency division multiplexed symbol,

wherein the spatial-frequency subcarrier modulation assignments are provided to a transmitting station to transmit the symbol, and

wherein the receiver further comprises a subcarrier modulation assignment generator to determine the spatial-frequency subcarrier modulation assignments based on channel characteristics of the spatial channels prior to transmission to the transmitting station.

19. A method comprising:

parsing a block of bits representing an orthogonal frequency division multiplexed symbol into groups having a variable number of coded bits;

individually modulating the groups of bits on orthogonal frequency division multiplexed subcarriers in accordance with spatial-frequency subcarrier modulation assignments to generate symbol-modulated subcarriers; and

generating time domain waveforms by performing an inverse fast Fourier transform (IFFT) on the symbol-modulated subcarriers for subsequent RF transmission over a plurality of spatial channels.

20. The method of claim 19 further comprising:

generating the orthogonal frequency division multiplexed subcarriers with a null at substantially a center frequency of the other subcarriers to achieve substantial orthogonality between the subcarriers; and

transmitting the time domain waveforms over a corresponding one of the spatial channels, wherein the time domain waveforms together comprise the orthogonal frequency division multiplexed symbol.

21. The method of claim 20 wherein the spatial channels have at least slightly different multipath characteristics, the spatial channels being non-orthogonal channels comprising the orthogonal frequency division multiplexed subcarriers of the same subcarrier frequencies, and

wherein the variable number of coded bits of each group is based on one of the spatial-frequency subcarrier modulation assignments for a corresponding one of the orthogonal frequency division multiplexed subcarriers and a corresponding one of the spatial channels.

22. A method comprising:

generating frequency domain representations of a symbol received over orthogonal frequency division multiplexed subcarriers over a plurality of spatial channels;

demodulating the frequency domain representations for the subcarriers separately for each of the antennas in accordance with spatial-frequency subcarrier modulation assignments to generate groups of bits; and

generating the symbol from the groups of bits.

23. The method of claim 22 wherein the symbol is an orthogonal frequency division multiplexed symbol, and wherein the method further comprises receiving the orthogonal frequency division multiplexed subcarriers, the subcarriers having a null at substantially a center frequency of the other subcarriers to achieve substantial orthogonality between the subcarriers.

24. The method of claim 22 wherein each spatial channel is provided by one of a plurality of spatially diverse antennas, each spatial channel having at least slightly different multipath characteristics, and

wherein each group comprises a variable number of coded bits based on the spatial-frequency subcarrier modulation assignment for a corresponding one

of the orthogonal frequency division multiplexed subcarriers and a corresponding one of the spatial channels.

25. A system comprising:

a plurality of substantially omnidirectional spatially-diverse transmit antennas; and

a transmitter, wherein the transmitter comprises:

a parser to parse a block of bits representing a transmit orthogonal frequency division multiplexed symbol into groups;

subcarrier modulators to individually modulate the groups of bits on orthogonal frequency division multiplexed subcarriers in accordance with spatial-frequency subcarrier modulation assignments to generate symbol-modulated subcarriers; and

IFFT circuitry to generate time domain waveforms from the symbol-modulated subcarriers for subsequent RF transmission by the spatially diverse transmit antennas.

26. The system of claim 25 further comprising a receiver, wherein the receiver comprises:

FFT circuitry to generate frequency domain representations of a receive orthogonal frequency division multiplexed symbol received over orthogonal frequency division multiplexed subcarriers by spatially diverse receive antennas;

subcarrier demodulators to demodulate the frequency domain representations in accordance with receive channel spatial-frequency subcarrier modulation assignments to generate groups of bits; and

a deparser to combine the groups of bits to generate a block of coded bits representing the receive orthogonal frequency division multiplexed symbol.

27. The system of claim 25 wherein one of the spatially diverse transmit antennas is to transmit a corresponding one of the time domain waveforms,

wherein the time domain waveforms together comprise the transmit orthogonal frequency division multiplexed symbol, and

wherein each orthogonal frequency division multiplexed subcarrier has a null at substantially a center frequency of the other subcarriers to achieve substantial orthogonality between the subcarriers.

28. A machine-readable medium that provides instructions, which when executed by one or more processors, cause said processors to perform operations comprising:

parsing a block of bits representing an orthogonal frequency division multiplexed symbol into groups having a variable number of coded bits;

individually modulating the groups of bits on orthogonal frequency division multiplexed subcarriers in accordance with spatial-frequency subcarrier modulation assignments to generate symbol-modulated subcarriers; and

generating time domain waveforms by performing an inverse fast Fourier transform (IFFT) on the symbol-modulated subcarriers for subsequent RF transmission over a plurality of spatial channels.

29. The machine-readable medium of claim 28 wherein the instructions, when further executed by one or more of said processors cause said processors to perform operations further comprising:

generating the orthogonal frequency division multiplexed subcarriers with a null at substantially a center frequency of the other subcarriers to achieve substantial orthogonality between the subcarriers; and

transmitting the time domain waveforms over a corresponding one of the spatial channels, wherein the time domain waveforms together comprise the orthogonal frequency division multiplexed symbol.

30. The machine-readable medium of claim 28 wherein the instructions, when further executed by one or more of said processors cause said processors to perform operations, wherein the spatial channels have at least slightly different multipath characteristics, each spatial channel being a non-orthogonal channel comprising the orthogonal frequency division multiplexed subcarriers of the same subcarrier frequencies, and

wherein the variable number of coded bits of each group is based on one of the spatial-frequency subcarrier modulation assignments for a corresponding one of the orthogonal frequency division multiplexed subcarriers and a corresponding one of the spatial channels.